(18.3) Under the same assumption as above, what amount of damage will be caused by cosmic radiation? Assume that the cosmic particles produce $3*10^9$ ion pairs s^{-1} m^{-3} of the body.

Constants and units (standard man is 70 kg):

$eV := 1.602137 \cdot 10^{-19} \cdot joule$ $\quad Bq := sec^{-1}$ $\quad M_w := 10^5 \cdot gm \cdot mole^{-1}$ $\quad t_{irr} := 1 \cdot yr$

$w_{pair} := 38 \cdot eV$ $\quad G_{value} := 3.1 \cdot 10^{-7} \cdot mole \cdot joule^{-1}$ $\quad m_{body} := 70 \cdot kg$

Data given in the text:

$Rate := 3 \cdot 10^9 \cdot Bq \cdot m^{-3}$

Calculations:

$\rho_{body} := 1 \cdot gm \cdot cm^{-3}$ $\quad v_{body} := \frac{m_{body}}{\rho_{body}}$

$P_{cosmic} := Rate \cdot w_{pair} \cdot v_{body}$ $\quad P_{cosmic} = 1.279 \cdot 10^{-9} \cdot watt$

$m_{damaged} := P_{cosmic} \cdot G_{value} \cdot t_{irr} \cdot M_w$ $\quad m_{damaged} = 1.25 \cdot 10^{-3} \cdot gm$

$Fraction := \frac{m_{damaged}}{m_{body}}$ $\quad Fraction = 1.787 \cdot 10^{-8}$

or

$Fraction = 1.8 \cdot 10^{-6} \cdot \%$